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Original Research Article

Analysis of Different Modality of Treatment in Floating Knee Injury

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Abstract

Background and Aim: Floating Knee injuries are complex injuries. The type of fractures, soft tissue and associated injuries make this a challenging problem to manage. Generally caused by high energy trauma, the soft tissue is often extensive damaged and life threatening injuries to the head, chest or abdomen may also be present. The aim of the present study was to study the different modality of treatment is Floating Knee Injury by various operative methods.

Materials and Methods: A total of 30 patients with floating knee injuries were managed over a 3 year period. This was a prospective study were both fractures of the floating knee injury were surgically fixed using different modalities. The associated injuries were managed appropriately. Assessment of the end result was done by the Karlstrom criteria after bony union.

Results: Road traffic injury is the most common cause mode of injury leading to floating knee injury. 95 % patients had open fractures. 8o% patients were having ligamentous injury. Majority of patients were operated within 72 hours of the injury. 85% patients required secondary bony procedure like bone grafting like autologous, artificial bone graft. 85 % patients required secondary plastic surgery procedures like split thickness graft and flaps and other like quadricepsplasty.

Conclusion: Floating knee injuries to be a group of complex injuries that needed careful assessment to detect poor prognostic factors (open, intra-articular, comminuted fractures) and associated injuries, surgical fixation of the fractures with thorough planning of surgeries and prolonged rehabilitation.

Keywords: Damage Control, Floating Knee, Knee Injuries, Polytrauma

Introduction

All fracture, is an individual problem and the decision to treat it by internal fixation or indeed conservatively should be based on realistic assessment of the advantages and hazards of each method in circumstances of those particular cases .This calls for high degree of clinical judgment which is harder to

acquire or to impart technical virtuosity in operating theatre [1-3].

Among all the open fractures tibia and femur is largest bone that is involved in open to the increase in vehicular accidents and industrial mishaps; high velocity trauma produces open tibial and femoral fractures. Stabilization of fractures by external fixations proved to be cumbersome, and high percentage of complication associated with casting and compression plating has led to increase in popularity of intramedullary nailing in tibia. Ipsilateral fractures of femur and tibia have been called "FLAOTING KNEE INJURY' and may include combinations of diaphyseal, metaphyseal and intra articular fractures [4,5].

Floating Knee injuries are complex injuries. The type of fractures, soft tissue and associated injuries make this a challenging problem to manage. Generally caused by high energy trauma, the soft tissue is often extensive damaged and life threatening injuries to the head, chest or abdomen may also be present. Many of these fractures are open, with associated vascular injuries. Surgical stabilization of both fractures and early mobilization of the patient and the extremity produce the best clinical outcomes [6,7].

The use of a radiolucent operating room table and the introduction of retrograde intramedullary fixation of femoral fractures have facilitated surgical stabilization of some floating-knee fracture patterns. Although treatment planning for each fracture in the extremity should be considered individually to achieve the optimal result, the effect of that decision must be considered in light of the overall injury status of the entire extremity [8].

Collateral ligament and meniscus injuries may also be associated with this fracture complex. Complications (such as compartment syndrome, loss of knee motion, failure to diagnose knee ligament injury, and the need for amputation) are frequent [9]. Better results and fewer complications are observed when both fractures are in diaphysis than when one or both are intra-articular. The aim of the present study was to study the different modality of treatment is Floating Knee Injury by various operative methods.

Material and Methods

This is prospective study of the "floating knee" injuries. All the patients were operated in our institute between MAY 2009 TO MAY 2012 and followed till average 18 months. A total of 30 patients with floating knee injuries were managed over a 3 year period. This was a prospective study were both fractures of the floating knee injury were surgically fixed using different modalities. The associated injuries were managed appropriately. Assessment of the end result was done by the Karlstrom criteria after bony union.

The patient was examined thoroughly for vital sign, head injury, thoracolumbar and abdominal injury and associated injuries. The distal circulation was checked and was examined for any neurological deficit. All the wounds were covered by sterile dressing after cleansing and normal saline wash. Full length roentgenogram in antero- posterior and lateral views was taken of affected leg. Temporary immobilization was given by above knee splint. Tetanus prophylaxis in form of Tetanus Toxoid and Tetanus immunoglobulin were given parenteral antibiotics and analgesics were started. All limbs were kept elevated on Bohler Braun splint in ward till patient got fitness for surgery. Knee ligament injuries were diagnosed by clinical assessment by the surgeon after surgical stabilisation of the fractures.

All open fractures regardless of grade were fixed with simple or hybrid external fixator. All closed floating knee injury, were treated using intramedullary nailing or Plate osteosynthesis where plate fixation was done by MIPO (minimal invasive plate

osteosynthesis), MIPPO (minimal invasive percutaneous platting osteosynthesis) or open reduction and buttress plate osteosynthesis, Antegrade or retrograde nailing of the femur and Antegrade nailing or plate osteosynthesis of the tibia allow rapid stabilization of the fractures and early mobilization.

Due to positioning problems, femoral neck and sub trochanteric femoral fractures should be addressed primarily without including the tibial fracture in the procedure. Attention should be given to the high incidence of knee ligament injuries found with this injury pattern. Physiotherapy and mobilisation was started as soon as possible after surgery. Patients were followed up regularly till bony union (clinical and radiological). Functional assessment and final outcome was measured using the Karlstrom's criteria after bony union.

Cardio pulmonary and general condition of patient was assessed by physician if patient was 35 years of age and above, Routine blood investigations, chest roentgenogram and electrocardiogram were performed, and Local parts were shaved and prepared for open trauma wounds.

Anesthesia

All the patients were operated under either spinal or general anesthesia. All the patients are treated in the supine position on the radiolucent table with a bump of two rolled sheets placed under the pelvis on the affected side. Patient is prepared and draped from the iliac to the foot. Open fracture wounds and areas of potential compartment syndromes are evaluated and treated before proceeding with fracture fixation. Femoral fracture is usually stabilized first. If the patient is haemodynamically unstable after the femur is nailed, the tibial fracture can be stabilized with a splint, and the patient can then return to the intensive care unit without the need of femoral traction.

Another advantage of primarily stabilizing the femur is the avoidance of inadvertent displacement of the femoral fracture that would occur with tibial nailing before femoral stabilization. Deformation if the tibial fracture can be controlled with manual reduction during stabilization of the femur. However, an unstable femoral fracture might displace and cause more soft-tissue injury when the knee is flexed for nailing of the tibia. If the tibia is much comminuted, or if femoral nailing is expected to be difficult, the tibial fracture should be stabilized with an external fixator before nailing the femur. Depending on the location and nature of the fracture, Antegrade intramedullary fixation is utilized. Retrograde nails are preferred if the femoral fracture dose not extend proximally into the subtrochanteric area. If there is an open knee injury, the femur and can be nailed through the knee laceration after thorough irrigation and debridement. If there is gross contamination that cannot be adequately debrided, Antegrade femoral nailing and tibial external fixation can be considered. If floating knee with an open tibial fracture, the lower leg should be irrigated and debrided before stabilizing the femur. The open tibial fracture can be secured with an external fixator or distractor to minimize additional soft-tissue injury while the femur is being nailed.

This fixator can then be changed to an intramedullary nail or left as fixation definitive based on the severity of the soft-tissue injury. When nailing the femoral fracture, the leg is carefully protected from undue deformation through the tibial fracture. The femoral fracture is reduced with manual distraction without causing angulation which would increase the soft-tissue injury. Applying manual traction may be difficult in patients with proximal tibial fracture.

In this situation, the surgeon should insert a distal femoral or proximal tibial traction pin that allows femoral traction without displacing the tibial fracture. If the tibial

fracture will be treated with an external fixator, the tibial fixator should be quickly applied before femoral fixation. Distal femoral fracture can also be treated by utilizing a radiolucent table. The incision for this procedure can be extended distally to allow treatment of either a proximal or a shaft fracture of tibial. A midline incision from the proximal patella extending down over the anterior portion of the tibia can accommodate retrograde fixation of a femoral shaft or supracondylar fracture, as well as internal fixation or intramedullary fixation of tibial fracture. The lateral incision used in the approach for condylar blade-plate fixation of distal femoral fracture can be extended distally and anteriorly to incorporate the exposure of the proximal tibia. If necessary, the incision used for the retrograde femoral nail may be extended distally and incorporated into the approach for the tibial plateau fracture. Non-displaced fractures extending into the knee may be best treated with percutaneous fixation and early range-of-motion activities.

These injuries have fewer complications than displaced intra-articular that require open reduction and internal fixation. Early weight bearing on diaphysial fracture should be delayed if the patient has an ipsilateral intra-articular fracture. Pain associated with the diaphysial fracture may also hinder the rehabilitation of the knee. The femoral neck fracture should be stabilized before addressing the tibial fracture. Although many surgeons fix this fracture on a fracture table, some prefer the standard radiolucent table.

Femoral neck fracture in young adults should be reduced and fixed in a timely fashion. In these situations, the femoral fracture should be stabilized first, and the patient should then be repositioned before addressing the tibial fracture.

Tibial plafond fracture likewise should be treated after the femoral fracture. Treatment of this injury should be selected without regard for the fracture of the femur. Tibial plafond fractures are best treated with primary closed reduction and external fixation.

Results

Table 1: Mode of injury

Mode of injury	No.	Percentage
vehicular injury	34	100%
Fall down	0	0
Assault	0	0
Others	0	0
Total	34	100%

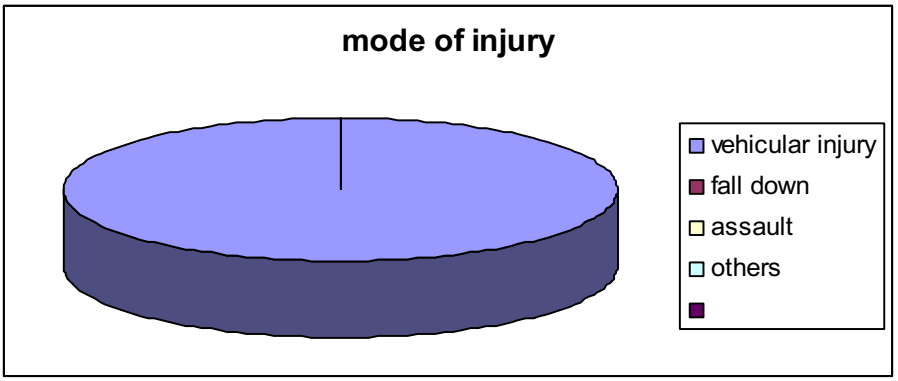

Figure 1

Vehicular accident was the only cause in our series to produce floating knee injury. This shows increased no of accidents due to high speed motor vehicle collisions.

Table 2: Side invovled

Side involved	No.	Percentage
Right lower limb	19	55.88%
Left lower limb	15	44.11%
Bilateral	0	100%

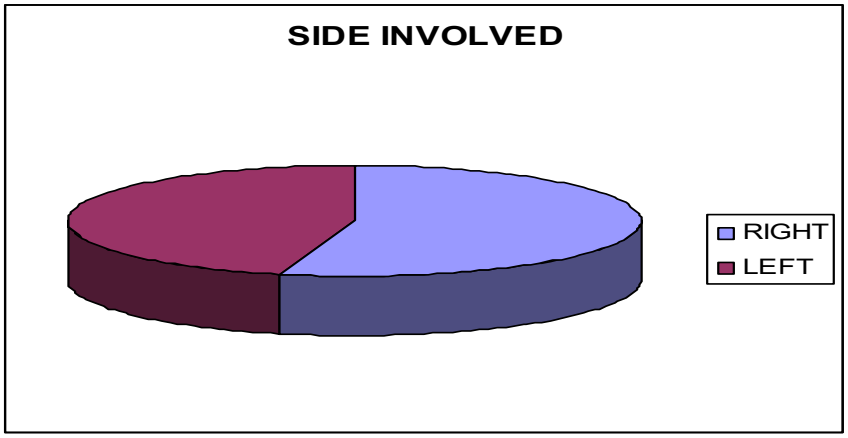

Figure 2

In this series, there is more right side involvement. Involvement of right side in large no of patient is not significant or having any logical co-relation.

Table 3: Category according to classifiction

	Number	Percentage (%)
Type I	6	17.64
Type IIA	10	29.41
Type IIBC	18	52.94
Total	34	100%

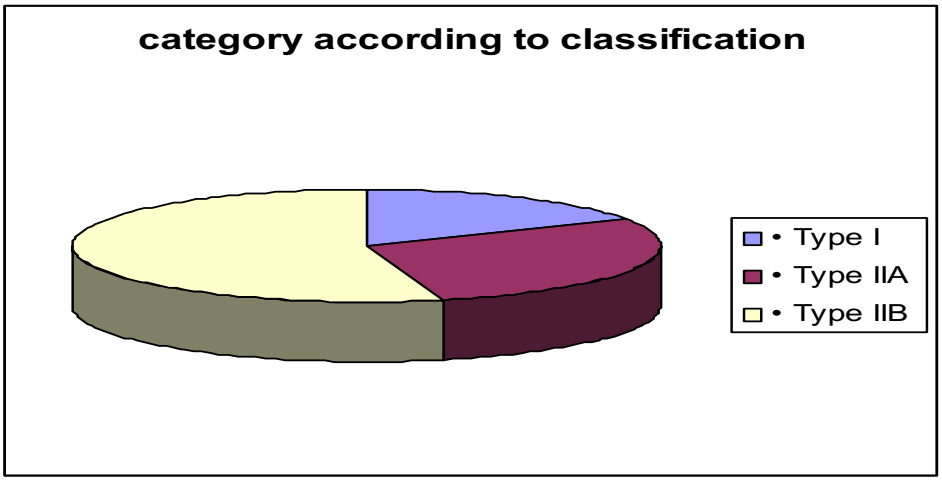

Figure 3

In this series open grade IIb type fractures is very common to occur.

Table 4: Associated injuries

Associated injuries	No.	Percentage
Head injury	4	11.76%
Systemic injury(abdominal injury)	2	05.88%
Associated fractures	3	08.82%

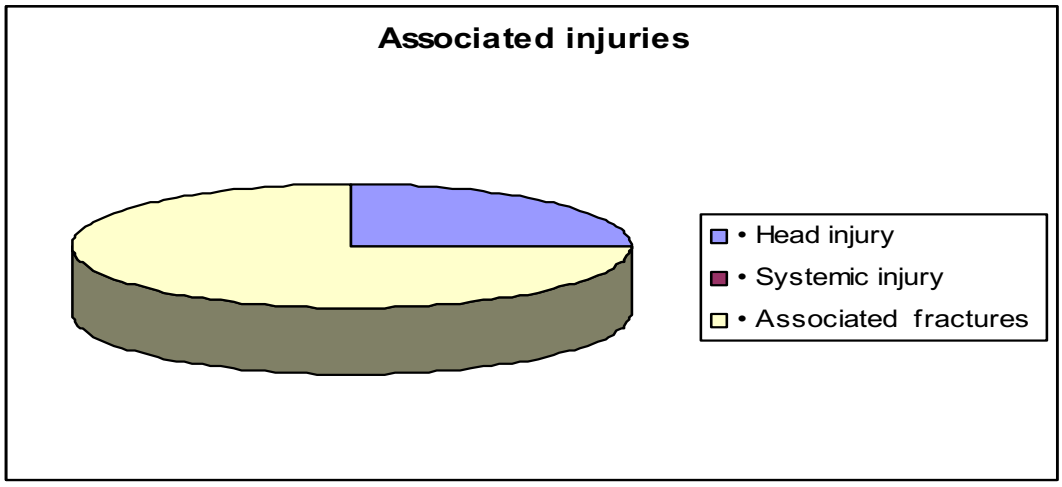

Figure 4

All associated injury was that of appendicular skeleton, ipsilateral or contralateral. Head, Chest and Abdominal injuries were most common cause of death in emergency department.

Table 5: Classification according to Gustilo-Anderson

	Number	Percentage
Closed	5	14.70%
Open grade I	5	14.70%
Open grade II	7	20.58%
Open grade IIIABC	17	50.00%
Total	34	100%

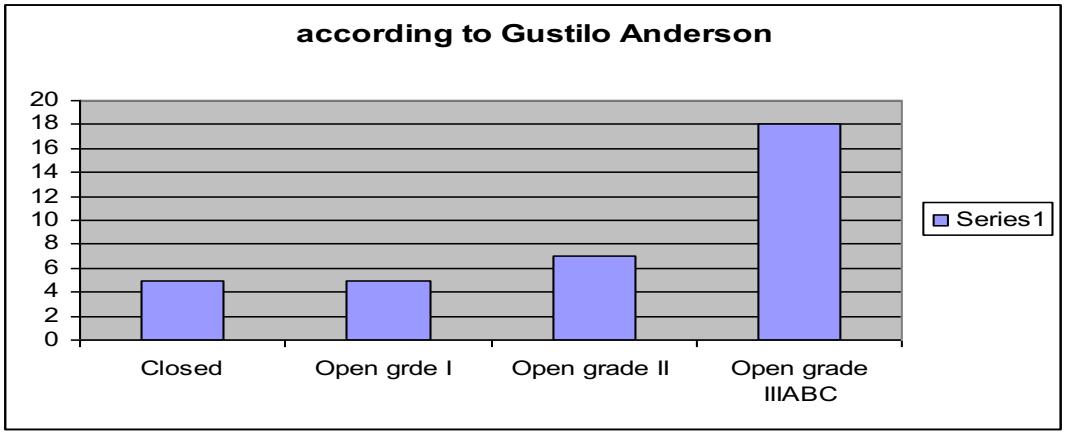

Figure 5

In this series concludes that most of the floating knee injuries are open injury with vascular involvement. The ratio of open /closed fractures was equal at 30:4

Table 6: Age Distribution of Patients

AGE(YEARS)	NO.OF PATIENTS	PERCENTAGE
20-30	6	17.64%
30-40	13	38.23%
41-50	10	29.41%
>50	5	14.70%

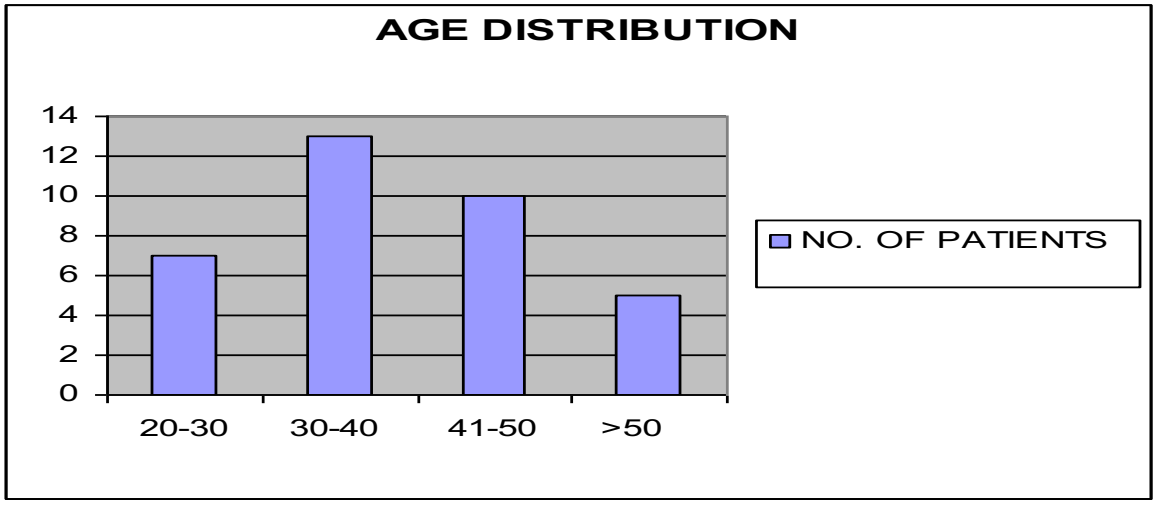

Figure 7

In our series, patient was age group 20 to 70 years ,average age was 38.43 years .There was increased incidence in the younger people noted in our series.

Table 7: Sex Distribution

Sex Distribution		
Sex	No. Of patient	Percentage
Male	30	88.23%
Female	4	11.76%

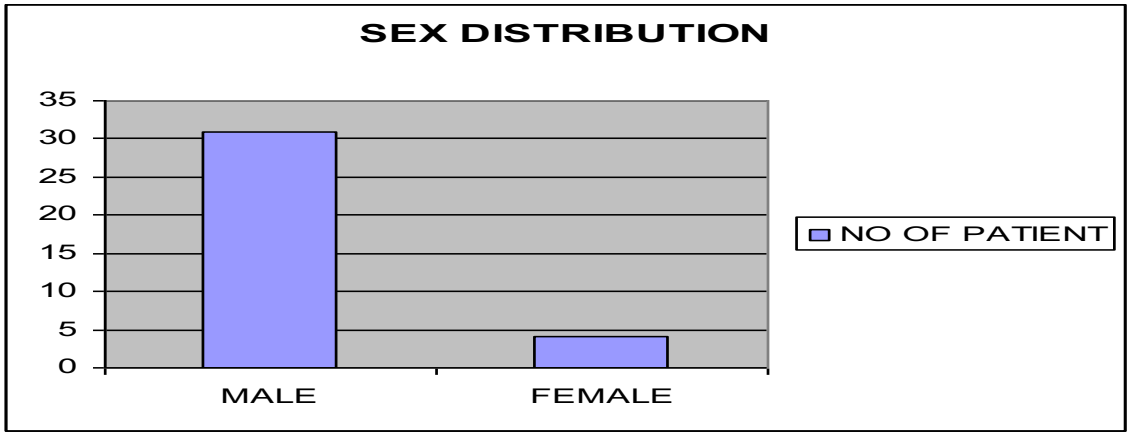

Figure 7

There is definitive male preponderance, because of road traffic accident.

Table 8: Occupation

Occupation	No. patients	Percentage
Laborer	17	50%
Farmer	13	38.23%
Housewife	4	11.76%
Total	34	100%

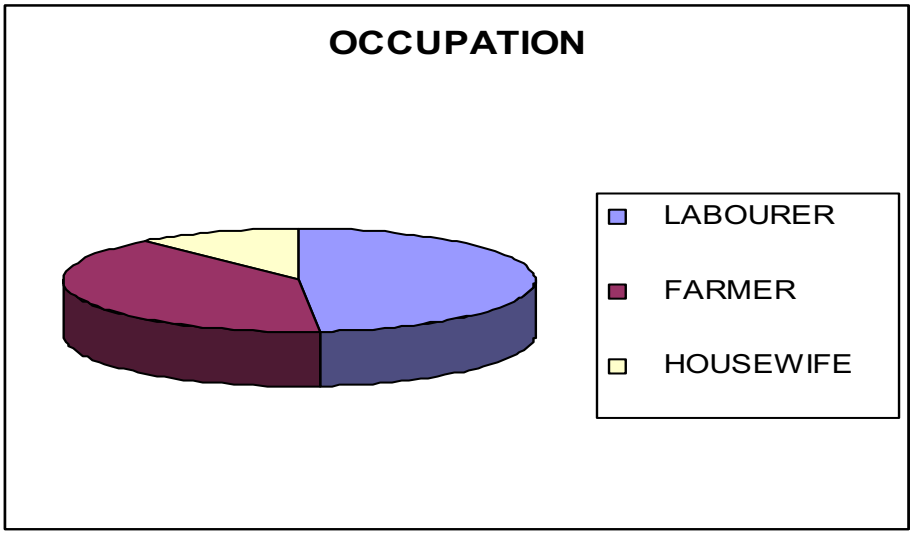

Figure 8

Laborer and farmer sustained maximum injury of femur and tibia in our series. All females were housewife and they sustained injury by vehicular accidents.

Table 9: Deformities

Deformities	No. of Patient	Percentage
Valgus	17	56.66%
Varus	12	40.00%
Rotational mal-alignment	01	3.33%

On final assessment 17 patients were Valgus deformity and 12 patients were varus and only 01 having rotational mal-alignment.

Table 10: Joint Movements Knee Range of Movement

Knee movement	No. of Patient	Percentage
No restriction	08	26.66%
<15 deg restriction	16	53.33%
15-30 deg restriction	04	13.33%
>30 deg restriction	02	6.66%
Total	30	100%

Table 11: Shortening

Shortening	No. of Patient	Percentage
1-2 cm	14	46.66%
3-5 cm	13	43.33%
6-10cm	03	1.11%
Total	30	100%

In this series conclude that most of floating injury patients having shortening.

Discussion

The associated injuries and the type of fracture (open, intra-articular, communation) are prognostic indicators in the Floating knee. Appropriate management of the associated injuries, external fixator, intramedullary nailing of both the fractures and post operative rehabilitation are necessary for good final outcome [10]. In children with ipsilateral femoral and tibial fractures, far better results were seen after operative treatment of their injuries.

Type II injuries often have worse outcomes than type I injuries. The different varieties of floating knee injuries necessitate individual consideration of the fracture type and the overall status of the soft tissues of the extremity [8,10].

Regardless of displacement, an optimal outcome after intra- articular fractures is dependent on stable fixation, early range-of-motion activities and protected weight bearing [11].

Intra-articular involvement of the fractures, higher skeletal injury scores and severity of soft tissue injuries are significant indicators of poor outcome results. preoperative scoring system which took into consideration the age, smoking status at time of injury, Injury severity scores, open fractures, segmental fractures and comminution to prognosticate the final outcome of these fractures [6,12].

The best results were seen when both fractures were treated by intramedullary nailing. We found that these patients returned to their normal level of activity earlier than when the fractures were treated with other modalities. Tibia fractures treated with external fixation had a longer union time probably related to the soft tissue injury and comminution at the initial injury. In our study patients with tibia plateau fractures who had knee stiffness and persisting pain in the knee while the other patient had a Grade 3B open tibia fracture treated by external fixation.

This shows that the poor prognostic factors were related to the type of fracture (open or closed, intra-articular fractures, severe comminution). The associated injuries played a major role in the initial outcome of patients in our study with regards to delay in initial surgery, prolonged duration of surgery, anaesthetic exposure and delay in rehabilitation. From our study we found Floating knee injuries to be a group of complex injuries that needed careful assessment to detect poor prognostic factors (open, intra-articular, comminuted fractures) and associated injuries, surgical fixation of the fractures with thorough planning of surgeries and prolonged rehabilitation. Combination of all these would determine the ultimate outcome of these patients.

When the knee joint is isolated partially or completely due to fracture of the femur and tibia the term "Floating Knee" is used. Survivors of high-speed traffic accidents often have injuries to several of the parenchymal organs as well as multiple fractures. Careful evaluation of these injuries and resuscitation of the patient must precede the definitive management of specific fractures Hayes JT [13] suggested that automobile passengers with floating knee braced their feet firmly

against the sloping floor of the front seat just prior to the collision, their legs getting crumpled under the massive decelerating forces produced by the impact. Pedestrians were frequently catapulted some distance from the point of impact and were further injured by striking the pavement. In a study of 222 cases of floating knee by Fraser, all cases were involved in road traffic accidents. Studies showed associated injuries like head injuries, chest injuries, abdominal injuries and injuries to other extremities. Most of the injuries to the head, chest and abdomen were life threatening. Adams, on *et al* in their study encountered 71% major associated injuries with 21% vascular injuries. The reported mortality rate ranged from 5% – 15%, reflecting the seriousness of the associated injuries .Deliberate and careful examination of the patient must be carried out in order to determine whether a major intracranial, abdominal or thoracic injury is present.

Such injuries should take precedence over extremity injuries in the priority of treatment. There are plenty of studies in the literature detailing different management options for the Floating Knee. Hayes JT opined that in a patient with multiple fractures in the same extremity, operative fixation of one or more of the fractures was valuable in the management of the entire limb. Ratcliff AH found that internal fixation of both the fractures should be done wherever possible as these patients were less likely to develop knee stiffness or shortening and were in hospital and off work for less time than those treated conservatively. Omer GE treated the, Floating Knee by both conservative and operative fixation found that where internal fixation was done for both femoral and tibia fractures, the healing time was about 8 weeks earlier than the group managed conservatively. Behr JT treated patients with the Floating knee by closed intramedullary nailing with Ender nails and achieved femoral union at an average of 10.3 weeks and tibial union at 18 weeks. Ostrum RF treated patients with a retrograde femoral tibial intramedullary nail through a 4 cm medial Para patellar incision. The average time to union of the femoral fractures was 14.7 weeks and that for the tibial fractures was 23 weeks. They opined that this method was an excellent treatment option. The general consensus in recent studies is that the best management for the Floating knee is surgical fixation of both the fractures with intramedullary nails. Dwyer used combined modalities of treatment with one fracture managed conservatively and the other surgically. They concluded that the treatment method for the tibia did not interfere with joint mobilization.

Lundy recommended surgical stabilization of the fractures for early mobilization which produced the best results. Theodoratos recommended intramedullary nailing as the best choice of treatment except for grade 3B & C open fracture. Single incision technique for nailing of both the fractures has been recommended by several authors. Rios J compared single incision versus traditional ante grade nailing of the fractures and found the former to have less surgical & anesthesia time with reduced blood loss. Shiedts found an increased incidence of fat embolism when both fractures were treated by reamed nails. Szalay demonstrated knee ligament laxity in 53% of patients while 18% complained of instability.

We have studied 34 factures, in this 30 patients were used prospectively studied in our series having varying degree of open and closed floating knee injury .There were 04 patients died in emergency department due to associated injury like head, chest and abdominal injury.

Conclusion

From our study we found Floating knee injuries to be a group of complex injuries that needed careful assessment to detect poor prognostic factors (open, intra-articular, comminuted fractures) and associated

injuries, surgical fixation of the fractures with thorough planning of surgeries and prolonged rehabilitation. Combination of all these would determine the ultimate outcome of these patients. So the of injury depends upon the Grading of fractures, Surgical wound, surgical time, intrarticular involvement .Those are main predictors of outcome.

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